We claim:

1. A method of supplying tap weights to taps of a decision feedback equalizer comprising:

determining a channel impulse response of a channel through which the decision feedback equalizer receives a signal;

determining constrained tap weights based on the channel impulse response and a differentiable tap weight constraint function, wherein the differentiable tap weight constraint function is an approximation of a non-differentiable tap weight constraint function; and,

supplying the constrained tap weights to the decision feedback equalizer.

2. The method of claim 1 wherein the differentiable tap weight constraint function comprises an approximation of a 1-norm tap weight constraint function.

3. The method of claim 1 wherein the decision feedback equalizer comprises a feed forward filter having feed forward taps and a feedback filter having feedback taps, wherein the determining of constrained tap weights comprises (i) determining constrained tap weights for the taps of the feedback filter based on the differentiable tap weight constraint function and (ii) determining unconstrained tap weights for the taps of the feed forward filter, and wherein the supplying of the constrained tap weights to the decision feedback equalizer comprises (i) supplying the constrained tap weights to the feedback filter and (ii) supplying the unconstrained tap weights to the feed forward filter.

4. The method of claim 3 wherein the differentiable tap weight constraint function comprises an approximation of a 1-norm tap weight constraint function, and wherein the differentiable tap weight constraint function comprises a function of the feedback taps.

5. The method of claim 1 wherein the determining of a channel impulse response comprises determining the channel impulse response and a signal-to-noise ratio characterizing the channel, and wherein determining of constrained tap weights comprises determining the constrained tap weights based on the channel impulse response, the signal-to-noise ratio, and the differentiable tap weight constraint function.

6. The method of claim 5 wherein the differentiable tap weight constraint function comprises an approximation of a 1-norm tap weight constraint function.

7. The method of claim 5 wherein the decision feedback equalizer comprises a feed forward filter having feed forward taps and a feedback filter having feedback taps, wherein the determining of constrained tap weights comprises (i) determining constrained tap weights for the taps of the feedback filter based on the differentiable tap weight constraint function and (ii) determining unconstrained tap weights for the taps of the feed forward filter, and wherein the supplying of the

constrained tap weights to the decision feedback equalizer comprises (i) supplying the constrained tap weights to the feedback filter and (ii) supplying the unconstrained tap weights to the feed forward filter.

8. The method of claim 7 wherein the modified tap weight constraint function comprises a 1-norm tap weight constraint function, and wherein the differentiable tap weight constraint function comprises a function of the feedback taps.

9. The method of claim 1 wherein the differentiable tap weight constraint function is given by the following expression:

$$\sum_{m=0}^{N_{FB}} f(g[m]) \leq M$$

wherein f(g[m]) is given by the following expression:

$$f(x) = \begin{cases} |x| & if\ |x| \geq \gamma \\ f_0 + f_2 x^2 + f_4 x^4 & if\ |x| < \gamma \end{cases}$$

wherein $x = g[m]$, wherein $g[m]$ are the tap weights, wherein N_{FB} are the number of the taps, and wherein γ, M, f_0, f_2, and f_4 are selected values.

10. The method of claim 9 wherein M = 1, 2, or 3, $\gamma = M/1000$, $f_0 = 3\gamma/8$, and wherein f_2 and f_4 are determined in accordance with the following expressions:

$$f_2 = \frac{3}{2\gamma} - 2\frac{f_0}{\gamma^2}$$

$$f_4 = \frac{1}{\gamma^4}\left(f_0 - \frac{\gamma}{2}\right).$$

11. The method of claim 1 wherein the decision feedback equalizer comprises a feed forward filter having feed forward taps and a feedback filter having feedback taps, wherein the differentiable tap weight constraint function is given by the following expression:

$$\sum_{m=0}^{N_{FB}} f(g_B[m]) \leq M$$

wherein $f(g_B[m])$ is given by the following expression:

$$f(x) = \begin{cases} |x| & if\ |x| \geq \gamma \\ f_0 + f_2x^2 + f_4x^4 & if\ |x| < \gamma \end{cases}$$

wherein $x = g_B[m]$, wherein $g_B[m]$ are the tap weights of the feedback taps, wherein N_{FB} are the number of the feedback taps, and wherein γ, M, f_0, f_2, and f_4 are selected values.

12. The method of claim 11 wherein M = 1, 2, or 3, $\gamma = M/1000$, $f_0 = 3\gamma/8$, and wherein f_2 and f_4 are determined in accordance with the following expressions:

$$f_2 = \frac{3}{2\gamma} - 2\frac{f_0}{\gamma^2}$$

$$f_4 = \frac{1}{\gamma^4}\left(f_0 - \frac{\gamma}{2}\right).$$

13. A decision feedback equalizer comprising:

a feed forward filter that applies feed forward taps to a signal to be equalized, wherein the signal to be equalized is based on transmitted symbols;

a decision device;

a feedback filter that applies feedback taps to an output of the decision device;

a summer that sums outputs from the feed forward filter and the feedback filter to provide the output of the decision feedback equalizer, wherein the output of the decision feedback equalizer is provided to the decision device; and,

a tap weight determiner that determines constrained tap weights and unconstrained tap weights in response to the output of the decision device and the signal to be equalized in order to minimize the mean squared error between the transmitted symbols and the output of the decision feedback equalizer, wherein the constrained tap weights are determined by constraining the minimum mean squared error subject to a tap weight constraint function, wherein the tap weight constraint function is differentiable and is an approximation of a

non-differentiable tap weight constraint function, and wherein the tap determiner supplies the constrained tap weights to the taps of the feedback filter and the unconstrained tap weights to the taps of the feed forward filter.

14. The decision feedback equalizer of claim 13 wherein the tap weight constraint function comprises an approximation of a 1-norm tap weight constraint function of the feedback taps.

15. The decision feedback equalizer of claim 13 wherein the tap weight constraint function is given by the following expression:

$$\sum_{m=0}^{N_{FB}} f(g_B[m]) \leq M$$

wherein $f(g_B[m])$ is given by the following expression:

$$f(x) = \begin{cases} |x| & if\ |x| \geq \gamma \\ f_0 + f_2 x^2 + f_4 x^4 & if\ |x| < \gamma \end{cases}$$

wherein $x = g_B[m]$, wherein $g_B[m]$ are the tap weights of the feedback taps, wherein N_{FB} are the number of the feedback taps, and wherein γ, M, f_0, f_2, and f_4 are selected values.

16. The decision feedback equalizer of claim 15 wherein M = 1, 2, or 3, $\gamma = M/1000$, $f_0 = 3\gamma/8$, and wherein f_2 and f_4 are determined in accordance with the following expressions:

$$f_2 = \frac{3}{2\gamma} - 2\frac{f_0}{\gamma^2}$$

$$f_4 = \frac{1}{\gamma^4}\left(f_0 - \frac{\gamma}{2}\right).$$

17. The decision feedback equalizer of claim 13 wherein the tap weight determiner includes a channel impulse response estimator and a tap weight calculator, wherein the channel impulse response estimator determines a channel impulse response for a channel through which the signal is received, wherein the tap weight calculator determines the constrained tap weights and the unconstrained tap weights in response to the output of

the decision device and the signal to be equalized in order to minimize the mean squared error between the transmitted symbols and the output of the decision feedback equalizer.

18. The decision feedback equalizer of claim 17 wherein the tap weight constraint function comprises an approximation of a 1-norm tap weight constraint function of the feedback taps.

19. The decision feedback equalizer of claim 17 wherein the tap weight constraint function is given by the following expression:

$$\sum_{m=0}^{N_{FB}} f(g_B[m]) \leq M$$

wherein $f(g_B[m])$ is given by the following expression:

$$f(x) = \begin{cases} |x| & if\ |x| \geq \gamma \\ f_0 + f_2 x^2 + f_4 x^4 & if\ |x| < \gamma \end{cases}$$

wherein $x = g_B[m]$, wherein $g_B[m]$ are the tap weights of the feedback taps, wherein N_{FB} are the number of the feedback taps, and wherein γ, M, f_0, f_2, and f_4 are selected values.

20. The decision feedback equalizer of claim 19 wherein M = 1, 2, or 3, $\gamma = M/1000$, $f_0 = 3\gamma/8$, and wherein f_2 and f_4 are determined in accordance with the following expressions:

$$f_2 = \frac{3}{2\gamma} - 2\frac{f_0}{\gamma^2}$$

$$f_4 = \frac{1}{\gamma^4}\left(f_0 - \frac{\gamma}{2}\right).$$

21. A method of supplying tap weights to taps of a decision feedback equalizer comprising:

determining a channel impulse response of a channel through which the decision feedback equalizer receives a signal;

estimating an error at the output of the decision feedback equalizer;

determining a constraint value M as a function of the estimated error;

determining constrained tap weights based on the channel impulse response and a tap weight constraint function having the constraint value M; and,

supplying the constrained tap weights to the decision feedback equalizer.

22. The method of claim 21 wherein the tap weight constraint function comprises a differentiable approximation of a 1-norm tap weight constraint function.

23. The method of claim 21 wherein the decision feedback equalizer comprises a feed forward filter having feed forward taps and a feedback filter having feedback taps, wherein the determining of constrained tap weights comprises (i) determining constrained tap weights for the taps of the feedback filter based on the tap weight constraint function and (ii) determining unconstrained tap weights for the taps of the feed forward filter, and wherein the supplying of the constrained tap weights to the decision feedback equalizer comprises (i)supplying the constrained tap

weights to the feedback filter and (ii) supplying the unconstrained tap weights to the feed forward filter.

24. The method of claim 23 wherein the tap weight constraint function comprises a differentiable approximation of a 1-norm tap weight constraint function of the feedback taps.

25. The method of claim 21 wherein the determining of a constraint value M as a function of an output of the decision feedback equalizer comprises determining the constraint value M as a linear function of the output of the decision feedback equalizer.

26. The method of claim 21 wherein the determining of a constraint value M as a function of an output of the decision feedback equalizer comprises determining the constraint value M as a first linear function when the mean squared error between the received signal and the output of the decision feedback equalizer is below a threshold Th_L and as a second linear function when the mean squared error between the received signal

and the output of the decision feedback equalizer is above a threshold Th_H.

27. The method of claim 26 wherein the first linear function has a proportionality constant α, wherein the second linear function has a proportionality constant β, and wherein the proportionality constants α and β are equal.

28. The method of claim 26 wherein the first linear function has a proportionality constant α, wherein the second linear function has a proportionality constant β, and wherein the proportionality constants α and β are unequal.

29. The method of claim 21 wherein the estimating of an error at the output of the decision feedback equalizer comprises estimating a mean squared error at the output of the decision feedback equalizer.